

Bikability In Metropolitan Lagos: A Conceptualization of Eco Friendly Transportation Alternative

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1 ABSTRACT

Mobility induced city air pollution is evident in the metropolis where governments annual budgets emphasized road transportation and car ownership at the detriment of ferry, rapid and light rail transit systems. Alternative mobility frame work advocates for circulatory facilities including sidewalks, walkways, paths and bike lanes. These facilities minimally impact cityscape, rely on renewable energy, use less urban space, reduce traffic congestion, improve physical fitness and are cheaper. This paper explores conceptual framework for bicycle as an eco friendly transportation system in Lagos.

The study identified the fear of accident and the absence of 'changing rooms' in most public destinations as major constrains to the acceptance of bicycle as transportation mode. The later reason is due to the fact that Lagos is a hot and humid tropical city. Leisure cycling was however accepted as a recreational undertaking. An off road bicycle route system was conceptualized using satellite imagery, geographic information system and AutoCAD as design tools and Lagos State physical planning development control standards. 52 kilometers 'off road' bicycle route case study between Ikeja as point of departure and Bariga/Yaba as destination was undertaken. The route falls within setback of Ogbe and Iyaaloro rivers flood plain refered to as tertiary sytem 1 and 2 and railway setback. It is apparent that acceptability of bicycle as effective transportation mode in the city will be triggered by sustained interest in leisure cycling. The Paper recommends that LAMATA (Lagos Metropolitan Area Transport Authority) should embark on categorization of bicycle policies as general policies, facility policies and issue-based policies that will provide a practical guide to sustainable non-motorized transportation mode.

2 INTRODUCTION

The realization that scientific urbanism is unable to manage the waste products of the technology that define it continue to attract discussions on the health of the city. The philosophy of architectural modernism treats cities as architectural objects on regional landscapes crisscrossed by highly geometric streets that sustain automobile mode of transportation. The shortcomings of this technologically inspired urban concept is the inability to manage the wastes from supporting resources especially emission of hazardous gases from thousands of automobiles that daily load the streets. The destructive impact of gaseous emissions from fossil fuel driven engines especially nitrogen dioxide, voltaic organic compounds and carbon dioxide is worrisome. Nicholls (2004) referred to this destructive effect as degradation of life support system since they play major role in the depletion of ozone layer. The much celebrated modernism school of urban design collapsed under the weight of the very transportation technology that set it up. The desire to solve transportation induced urban pollution pushed mobility in urban centers to sustainable paradigm.

Mobility induced city air pollution is evident in metropolitan Lagos where governments annual budgets emphasized road transportation and car ownership at the detriment of ferry, rapid and light rail transit systems. About 40% of all new vehicle registration in Nigeria are in Lagos and accounts for 40% of the total national premium motor spirit consumption (Olowoporoku, 2007). Over 27,500 automobiles excluding commercial motor cycles load the streets on daily basis (Loricamp, 2007). 95% of these vehicles were manufactured over ten years ago without catalytical converters to minimize noxious effluents. Vehicular density is estimated at 220 vehicles per kilometer compare to national average of 1.1 vehicles per kilometer (LSG, 2006). About 20 years ago commercial motorcycle emerged to complete auto based transportation mode. Arbirage (1997) analysis of the city traffic showed an earlier domination by bus, 53%; private cars, 23.5%; taxi 18,5%; and commercial motorcycle 5% bringing to reality the continuous reliance on automobile transportation mode. Recent studies revealed that the metropolis has daily passenger trips record of about 6 million people (LSG,2006). 75 % of these trips are by bus based public transportation system; 24% cars and a negligible 1% rail and ferry service. None of these studies highlighted modal split in the metropolis. The problem of land transportation is not restricted to congestion but also deteriorating infrastructures, high consumption of non renewable hydrocarbon energy and polluted air space.

Air quality of the metropolis is a reflection of long hours of traffic congestion (Loricamp, 2007). There is no systematic measurement of the air quality in Lagos; however a few studies have reported measurements of green house gases especially carbon monoxide and volatile organic compounds. Arbitrage (1997) attributed 11.37 tons of volatile organic compounds per year; 175.4 tons of carbon monoxide per year; 297 tons of nitrous oxide per year; and 32 tons of sulphur dioxide per year to motorized road transportation mode. These gaseous effluents did not include emissions from generators as alternative energy source at both residential and industrial estates. According to LASEPA (2001) carbon monoxide measurement at Oba Akinjobi Way, Arch Bishop Vinning Memorial Church, Immigration Junction and Lagos Country Club/ Joel Ogunnaike Street at Ikeja was 63ppm, 27ppm, 67ppm and 72ppm respectively.

Mitigating measures for climate change, demand reduction of carbon dioxide and other green house gases emissions by 60-80% (WWF 2008),. This calls for the development of new energy saving transportation strategies. Sustainable transportation planning as a remediation tool for local air quality problems respect renewable energy sources. Within the context of sustainable urban design, non motorized transportation facilities give priority to walkways, sidewalks, public paths, trails, bike lanes and generous arterial road shoulders. These facilities accommodate a diverse range of users including people standing, sitting, children playing games, vendors, walkers and physically challenged individuals. Transportation modes supported by these facilities include wheel chairs, joggers, skating boards and bicycles. Bicycling minimally impact cityscape, rely on renewable energy, use less urban space, reduces traffic congestion, and improves physical fitness. This paper explores conceptual framework for bicycle as an eco friendly transportation system in Lagos metropolis.

Metropolitan Lagos developed on low lying sand barrier-lagoon coastal geomorphology at an average elevation of 3 meters above sea level. It is characterized by loose sedimentary sandy soil formation that supports fragmented fragile riparian landscape delineated by wetlands. The metropolis is framed by longitudes 2 0 42/ E and 30 22/ E of the Greenwich Meridian and latitudes 6 0 22/ N and 6 0 42/ N of the equator. Littoral climatic variables prevail throughout the year. Ikeja and Shomolu local government areas of northern metropolitan area are chosen for the case study. The study area is an agglomeration of 15 communities with a total population of about 955,000 (nine hundred and fifty five thousand) people.

3 SUSTAINABLE TRANSPORTATION PRINCIPLES

Sustainable transportation play dominant role in the transformation of existing urban centers into healthy ecological cities. Such mobility framework does not endanger public health but accommodate transportation modes that depend renewable energy resources. Sustainable city transportation network is an urban design concept that emphasis the importance of reducing the number of pollution generating fossil fuel driven automobiles. This study is underpinned by ecological design concept and Community Cycling Accessibility Initiative (CCAI) philosophy. Ecological urban design concept is the incorporation of the knowledge of how nature operates into city process. When human settlements take advantage of natural processes that makes the ecosystem functional then a healthy urban ecosystem is borne. This is what Register (1992) referred to as 'eco city'. It is a city conceptualized on minimal developmental impact; inhabited by people committed to efficient energy, water and food consumption; and pay much attention to generated wastes especially gaseous, heat and liquid emissions. Ecologically designed human settlement takes advantage of available energy sources and demands that open spaces, streets and transportation medium meet high energy efficiency standards (Downton, 2003).

Ecocity strives for minimum use of automobiles as transportation mode. It promotes low energy consumption automobiles, zero-emission vehicles including electric vehicle and integrated public mass transportation strategy that are technology driven. Ecocity transportation measure at this level may not be feasible as a result of shortage of man power and high technological cost. Shifting the attention from automobile transportation must evolve a policy underpinned by the philosophy of 'city for public mass transit system, pedestrians, and cyclist. Streets of such cities must then be conceived to be pedestrian friendly. Community Cycling Accessibility Initiative (Vanek and Spindler, 1999). is one of the several conceptual frameworks for non motorized transportation mode.

The core mission of Community Cycling Accessibility Initiative (CCAI) is to encourage cycling especially transport oriented cycling that reduces car trips through improvement of existing cycling infrastructure and construction of new ones. CCAI allows for combining 'both leisure and non leisure cycling into a single

campaign to provide safe cycling routes where people can travel to and from amenities they need' (Vanek and Spindler, 1999). Amenities refer to active nodal spaces including bus terminals, schools shopping complex, offices and commercial establishments. The argument in favour of CCAI is that government should invest in cycling infrastructure just as road network is currently funded. CCAI advocated four criteria to be used in identifying most suitable locations for bicycle infrastructure including sufficient population density, predominant use of automobiles in the current situation, sufficient space for adding new infrastructure with community interest in mind and high rate of bicycle ownership.

While metropolitan Lagos satisfies the first three factors, ownership of bicycle is very low. So insignificant is the place of cycling as transportation mode in the city that recent transportation studies including Arbirage (1997), LSG (2006), Loricamp (2007), Olowoporoku (2007) and Rom and Phoenix (2007) did not consider it in their report. Rather emphasis was on fresh public mass transit policies. The solution to automobile based traffic congestion in cities demands a deliberate change in transportation policies that will reduce automobile traffic. Such policies must respect the role of non motorized and car free planning. Non motorized facilities include walkways, sidewalks, crosswalks, paths, pedestrianized streets, pedestrian plazas, bike lanes and highway shoulders. The starting point is to identify the current modal split of Lagos commuting population. Modal split refers to the form of transportation a person chooses, including walking, bicycling, public transit, and driving cars. The aim of this study is to increase the percentage of people who will choose to bicycle rather than travel by automobile in the metropolis. This is because every motor vehicle trip traveled that is eliminated represents a quantifiable reduction in air pollution and traffic.

3.1 METHODOLOGY

The first phase of this study recognizes participatory research as a viable physical planning tool for people oriented transportation program. Relevant primary data was obtained through a combination of three descriptive survey instruments including questionnaire, semi structured interviews and personal observation. Administered questionnaires took into consideration age group and focused on the choice of transportation options and acceptability of bicycle as a recreation and transportation mode. The structured open-ended interview was drawn to collect information from the public about their views on the current transportation mode and expectations on cycling in the city. The primary data were analyzed to understand feasible options that will accommodate new bicycle infrastructure within the metropolitan setting. The later recognizes previous research works and planning reports as authentic secondary source of information. Desk top studies took into consideration Lagos State Metropolitan Plan (LSD 1985); Lagos State Review Regional Master Plan (Ashinyanbi 2005); Ikeja Model City Plan (IMCP 2008). Desk top studies focused on the compliance of the study area to positive bicycle facilities physical planning criteria meant to enhance livability in the metropolis. This constitutes the second phase of the study. Satellite imagery and digitized plans were analyzed to authenticate and update the physical state of the study area through direct observation. Updated base map was subjected to ecological city planning principles to proactively assess the readiness of the study area to accommodate eco friendly bicycle infrastructure.

4 PUBLIC PARTICIPATION IN CYCLING INFRASTRUCTURE

Engaging the public in the planning process is critical to the success of any transportation mode. The study revealed that 55% Lagos commuting population show preference for public mass transit followed by privately owned cars (35%). Figure 1 Shows that 8% will trek while the remaining 2% opt for cycling. Public mass transit refers to mini shuttle bus and the recently introduced Bus Rapid Transit (BRT) system with exclusive road lanes earmarked along major high ways in the metropolis. This has brought some level of relief to few commuters who hitherto rely on private cars. Figure 2 probes the present low interest level of bicycling in a metropolis that once relied heavily on cycling as transportation mode by the middle of last century. The fear of accident on the congested streetscape (57%); lack of public changing facilities at various destinations (20%); increasing crime rate and poor security (16%); and the stigma of attaching poverty to bicycling lower economic class at rural Lagos (7%) were reasons given for low interest in cycling. The latter is the legacy of crude oil economic illusion left behind by long years of military ruler ship and the flamboyant life style of extremely corrupt political elites. 71% of the respondents agreed that if the fear of accident on the busy roads and security of the cyclists are guaranteed then leisure cycling will be considered while the remaining 29% hinged their participation in non leisure cycling on availability of changing facilities at schools and government office complexes. The interest in leisure cycling is connected with the

dearth of public spaces in the city. Ashinyanbi (2005) noted that the ratio of planned hectare of open space per population in metropolitan Lagos dropped to an all time low figures of 90,000 people per hectare which was far from international standard of 300 per planned hectare. Any recreational infrastructure in the metropolis will boost the much needed leisure facilities. Leisure cycling is compatible with non motorized and car free planning philosophy. Nonmotorized modes are either developed along roadways or off road trails along urban natural corridors including parks and urban wilds.

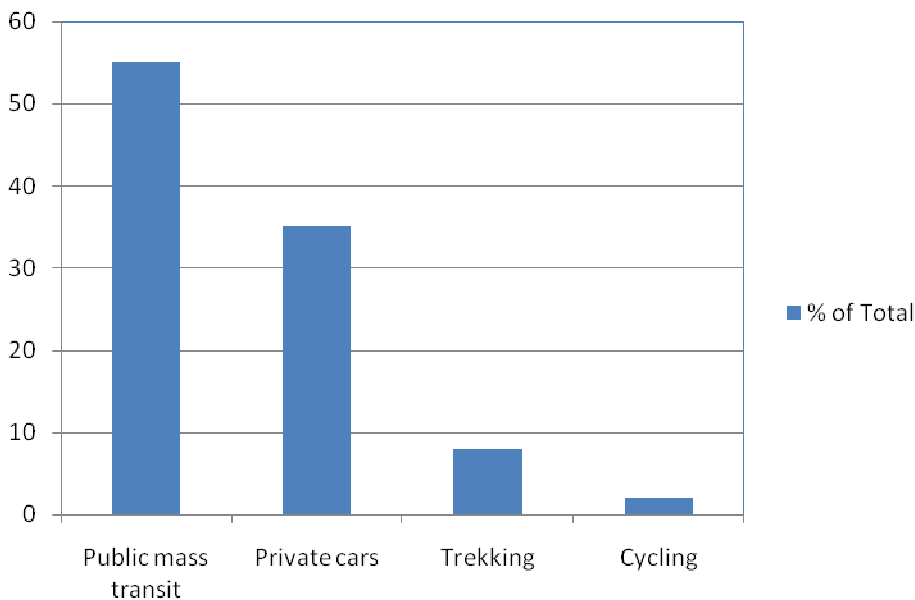


Figure 1. Lagos Commuters Transportation Preference

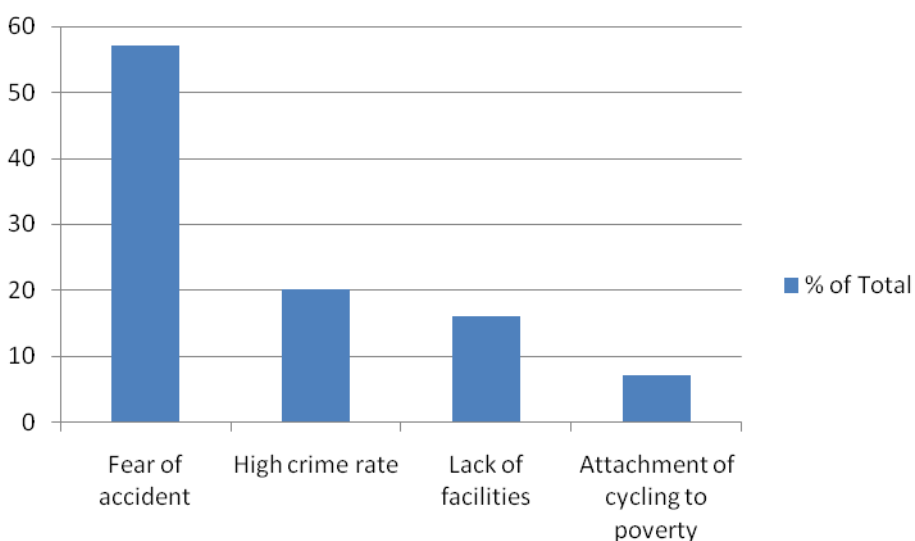


Figure 2 Present Low Interest In Cycling

5 LOCAL BICYCLE FRIENDLY AGENDA

Healing the urban landscape must take a holistic look at ecocity principles that can be accommodated within the present sociopolitical, economic, technological and human resources capability of the state government. Local sustainable transportation infrastructure planning model that can mitigate climate change impacts will be situated within Kenworthy (2006) conceptual model to enhance the compliance of existing cities to eco city principles. Kenworthy (2006) ‘sustainable urban form and transport factors’ reiterates the importance of compact, mixed-use urban form that uses land efficiently and protects the natural environment, biodiversity and food-producing areas. It is a high density development city concept that does not accommodate sprawling but have ample land area devoted to green infrastructure. This measure is easily and economically

achievable in new towns, new housing complexes and industrial estates. Currently Lagos streetscape is not planned to support non motorized transportation mode especially on-road bicycle route system. The existing streets are conceptualized as thoroughfares framed by silted open storm drainage channels with irregular concrete fence background along the beacon line. Introduction of energy saving transportation mode in already built up and highly populated metropolis demands high financial capital driven urban revitalization projects which the current economy may not support.

5.1 OFF ROAD NON MOTORIZED MODE - SUITABLE ROUTE

Yamakawa (1999) identified four categories of bicycle roads namely separate bicycle alone route, bicycle and pedestrian routes running side by side, on road bicycle track and on road bicycle and pedestrian track separated from vehicular lane. While the first two are ideal for off road route system the last two are part of existing streets and road right of way. Rehabilitating existing Lagos road to accommodate either of on road bicycle route system will be financially involving. Besides, the interest of the people at this point in time, is not on bicycle as a transportation mode but leisure cycling. As a starting point introducing off road non-motorized route system made up of walkway and bicycle on leisure platform may trigger the interest of the people in the nearest future. Possibility of safe off road bicycle route system is demonstrated for Ikeja and Shomolu local government areas in northern metropolitan area of Lagos (Figure 3). As noted by Ashinyanbi (2005), there is no planned metropolitan public park system. More compatible green land uses are the numerous wet lands that define the various communities and unplanned waterfront area. Drainage basins and flood plains separate the various townships and cities that make up the metropolis. There are six major natural drainage basins, at a total length of 112.22 kilometers (Table 3). These drainage basins are the city's tertiary drainage systems and are designated system 1 to 6. The northern metropolis is drained by systems 1 and 2. The most prominent is "system one" also known as 'Iyalaro' River that drains lower Ogba, Ikeja, Opebi, Ojota, Anthony and Ifako- Bariga townships into Lagos lagoon. System 2 drains Akoka, Bariga, Gbagada townships. These drainage system and other water bodies are secured by developmental control legal setbacks including 150 meters from the ocean, 75 meters from lagoon shoreline, 60 meters from rivers and 15 meters from canals (LSG1986)

SYSTEM	LENGTH
System 1	18.93km
System 2	7.0km
System 3	4.7km
System 4	7.09km
System 5	21.0km
System 6	53.5km

Fig. 3: Major Drainage Channels in Lagos Metropolis Length and Area (Source: World Bank Assisted Lagos Drainage and Sanitation Project 1998)

Subjecting the identified natural drainages and railway right of way to modified CCAI principle provides the opportunity for safe off road non motorized transportation mode made up of bicycle route system and walkways. CCAI allows for combining both leisure and non leisure cycling as unit to provide safe cycling routes where people can travel to and from important nodal spaces (Vanek and Spindler 1999). The first phase of CCAI principle is aligning safe cycle route through identified corridor with minimal obstructions at busy roads and other thoroughfares in the city. Bicycle route alignment along the natural basins took into consideration the upper terrace of the flood plain free from the peak annual flow of the rivers. This case study allows for 18 kilometers off road bicycle route along the flood plain upper terrace of 'System One' from Adeniyi Jones Ikeja township to Oworonsoki without crossing the highways. The alignment is conceptualized to run parallel to Iyaalaro River and using the existing under bridge pedestrian set back to escape crossing the two highways. A tributary of Iyaalaro River drains Pedro Township and constitutes system 1A and covers 4 kilometers. The cycle route alignment follows the 15 meters canal setback to connect System 2A. While system one has an average width of 100 meters, system two has been narrowed by developmental activities and now functions as manmade canal. The average width on each side of the canal is 15 meters being the setback prescribed for development control. The proposed off road bicycle route is set within the 15 meters set back. It emanates from University of Lagos and aligned along Ogbe River

canal (System 2A) which drains Shomolu and Gbagada townships. Linking System 1A and system 2A involves crossing 10 residential streets. These intersections must be addressed through traffic management mechanism.

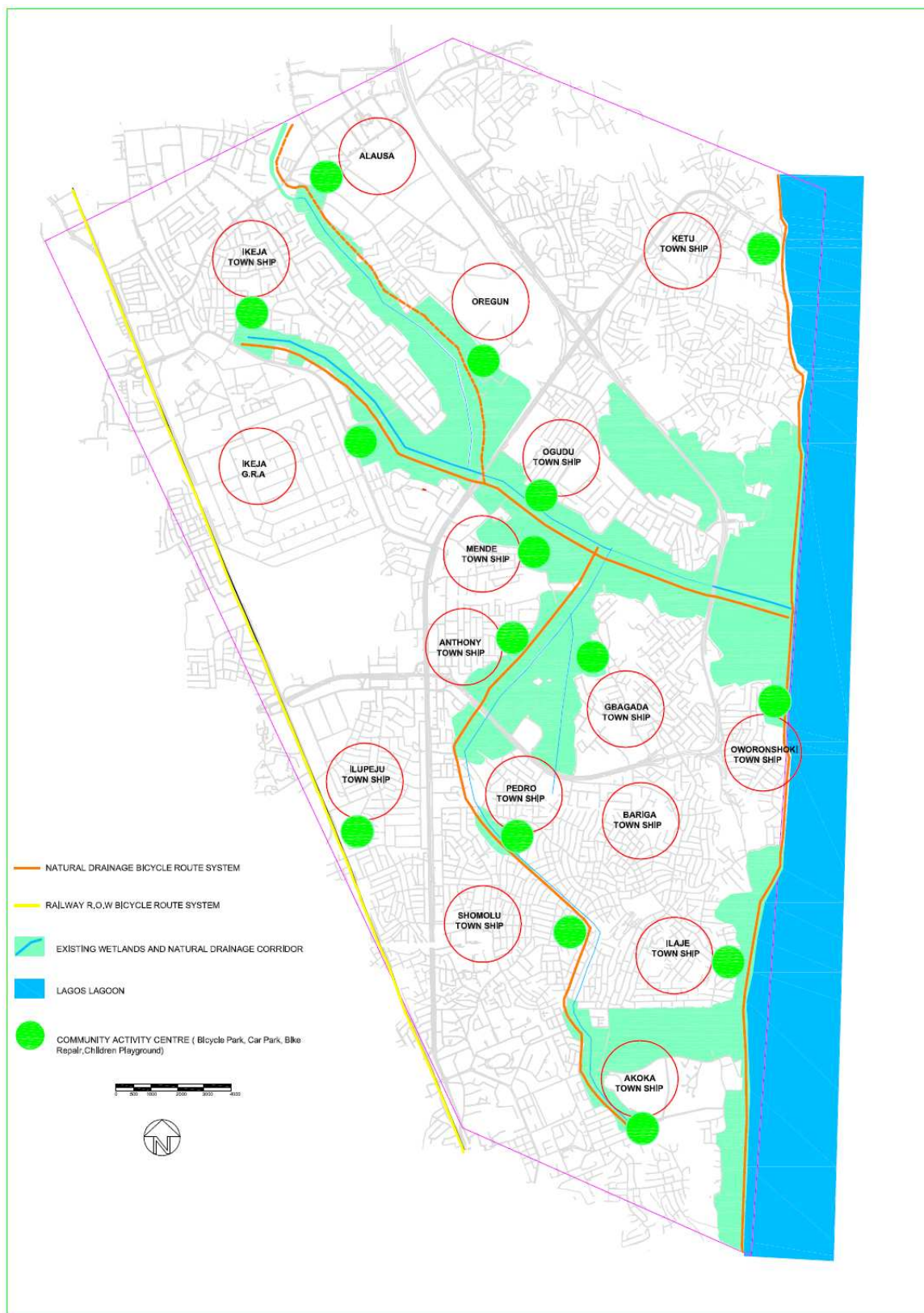


Figure 3 Possible Off Road Bicycle Route System

The 30 kilometers Nigeria Railway Corporation dual carriage rail line stretches from Iddo terminus in the south to Agege in the north. The minimum set back allowed between a building and railway line is 21 meters (LSG 1986). Aligning a three meter bicycle/ pedestrian route within the setback provide a vehicle free lane

for cyclists. This off road concept along the natural drainage and railway set back recognize other important elements including bicycle parks at adjacent communities; car parks; bicycle repair points and practicing tracks. In the absence of metropolitan park system, introduction of minor adventurous play ground might become the nucleus for adjoining communities to have a park. This leisure cycling concept. becomes a trigger for livable outdoor environment in hot and humid tropical city in dire need recreation centers

6 CONCLUSION AND RECOMENDATIONS

Bicycling was an important transportation mode in Lagos State until the advent of crude oil economy in 1970s. Unfortunately the rate at which people are biking to work decreased drastically in many urban communities within the metropolis. During this same period, life expectancy dropped while obesity increased, contributing to health problems in the city. These two trends are related, and demand the creation of livable built environment that accommodates bicycling as a key element to rectify the critical issues. This is a major challenge in the face of high costs of health care delivery, energy crises and reliance on vehicular transportation mode. The way forward for bicycle as a transportation mode and leisure facility resides in its immediate recognition. The recognition must commence from the introduction of non-motorized transport mode policy. Such policy should benefit from internationally acclaimed and tested 4Es bicycle planning philosophy namely engineering, education, enforcement and encouragement. Since successful bicycling programs involve education, engineering and enforcement efforts, diverse cross section of government ministries, agencies and parastatals must contribute to required policies. Prominent ministries include physical planning, environment, education, health and transport. While ministry of transport is expected to drive bicycle policy as an energy saving and eco friendly transportation mode, ministries of sport and health will jointly evolve bicycle related sports and recreation policies.

The stated hindrances to non leisure biking by residents including fear of accidents, insecurity and lack of changing facilities in destinations is not restricted to Nigeria. Such problems have been experienced in other cities and appropriate tested solutions that may be useful in Lagos devised. What is really needed at this point in time is a political will to accept non-motorized transport mode as an effective eco friendly alternative to mitigate negative impacts of hydrocarbon driven automobile mode. As noted by Yamakawa (1999) bicycle should be seen as a transport mode ideal for short distances to identified destinations within the city. Specific areas of focus to enhance the goal of an eco friendly bicycle as transportation mode in Lagos are as follows:

- Secure the various drainage basins and canals through strict application of development control instrument. This will checkmate encroachment by land speculator.
- Relate properly with railway and other Federal Government agencies that hold the potential right of ways in trust for the people.
- Consider the the incorporation of Lagos Traffic Operatives along the routes. The officers must be made to relate to security agents to allay the fears banditry along the lanes.
- Government transportation agency especially LAMATA (Lagos Metropolitan Area Transport Authority) should embark on categorization of bicycle policies as general policies, facility policies and issue-based policies that will provide a practical guide.

The later, issue based policies, are the most important at this point in time. Included are policies on sidewalks, crossings, trails in green areas, bicycle parking and changing facilities at civic buildings and public nodal spaces . Health and fitness, energy conservation, air quality, and safety must be given adequate priority to secure the confidence of the people bicycle riding.

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